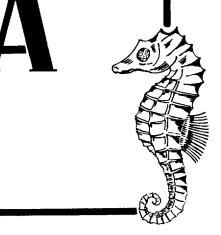
HISTORIC-

ALTON



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M. J. DOWD Executive Officer to the Board of Directors Imperial Irrigation District

Mr. M. J. Dowd, a graduate of California Institute of Technology, joined Imperial Irrigation District in July, 1922.

Because of his intimate knowledge of the Colorado River and water problems of the Southwest, he has played an important part in water conservation and irrigation district organization in California.

- Chief Witness and Expert Witness for State of California in Arizona vs. California Water Litigation.
- Unofficial Advisor to U.S. Commission of International Water Commission during treaty negotiations between United States and Mexico.
- Participated in District's negotiations of several All-American Canal Contracts, and Seven-Party Agreement among California Agencies with interests in the Colorado River.
- Member of California Districts Securities Commission since organization in 1931; Chairman since August, 1955.
- Member, Advisory Council, Water Resources Center, University of California.
- Member, American Society of Civil Engineers, and American Institute of Electrical Engineers. Registered Civil and Electrical Engineer, State of California, and Registered Engineer, District of Columbia.

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PROLOGUE

History of Imperial Irrigation District

The central portion of Imperial Valley is now under cultivation. This is known as the Imperial Unit of Imperial Irrigation District. It is a relatively flat plain, sloping from about sea level on the Mexican Border to about 235 feet below sea level at the surface of the present Salton Sea. The Colorado River flows along the crest of its delta in the Yuma area at almost 150 feet above sea level. To the east and west of the Imperial Unit are broad mesas which are proposed to be irrigated from the All-American Canal. These are known as the East Mesa Unit and the West Mesa Unit of the District.

The feasibility of bringing water from the Colorado River to irrigate Imperial Valley had been recognized since the 1850's. But it was not until May 1901 that the California Development Company completed, and commenced diversions into, a canal which had its heading in the United States (about one mile north of the international boundary) but which ran almost its entire length in Baja California, Mexico, before recrossing the boundary into Imperial Valley. Difficulty with silt at the first heading, after a few years, resulted in attempts to make a temporary diversion from the River a short distance downstream in Mexico. The new heading failed during a flood from the Gila River, and from the fall of 1905 to February 1907 the entire discharge of the Colorado River flowed into Imperial Valley, creating a large lake (now known as Salton Sea) in the northern part of the Valley. The break was finally closed in February 1907 by the Southern Pacific Company, which became the owner of the assets of the then bankrupt California Development Company and its Mexican subsidiary company.

Imperial Irrigation District Organized 1911

Imperial Irrigation District was organized in July 1911. The District acquired the properties of the California Development Company and its Mexican subsidiary from the Southern Pacific Company in June 1916 and the distribution canals in Imperial Valley proper from the numerous mutual water companies in 1922-23.

Passage by Congress in December 1928 of the Boulder Canyon Project Act made possible the construction of Hoover Dam and the Imperial Dam and All-American Canal system. One of the primary reasons for the construction of the Dam was the need for controlling the floods and silt content of

the Colorado River to prevent the eventual inundation of Imperial Valley. Lake Mead, the reservoir back of Hoover Dam, now has a usable storage capacity of 28,427,000 acrefeet, of which the upper 5,350,000 acrefeet is made available each year for flood control. The annual average flow of the River is approximately 12,500,000 acrefeet. Construction of Hoover Dam was commenced in 1930 and storage of water behind the Dam was started in February 1935.

Imperial Dam

The Imperial Dam provides a permanent point of diversion on the Colorado River, with adequate desilting works. The All-American Canal eliminates international complications which had resulted from the water supply for Imperial Valley passing through Baja California; the Canal also provides the District with a main canal with capacity sufficient to complete the development of all of the lands within its boundaries. Construction of the All-American Canal system was commenced in August 1934 by the United States Bureau of Reclamation, pursuant to a contract with the District dated December 1, 1932, and includes Imperial Dam (a diversion structure located about twenty-two miles north of the international boundary), three desilting basins in conjunction therewith, and an eighty-mile canal to and across the Imperial Unit of the District. This canal is located entirely within the United States. Since February 13, 1942, Imperial Irrigation District has been receiving all of its water through the All-American Canal.

All-American Canal

The All-American Canal also has a branch which diverts from the main canal about forty miles below the Dam and extends northerly to and around Coachella Valley. For the first 49 miles, this branch canal is designed to serve the East Mesa Unit also. This canal was completed in 1949 and is now serving water to lands in Coachella Valley through an extensive underground distribution system.

Morelos Dam, one mile south of the international boundary, was completed in 1950 and diverts water into the old Alamo Canal for use on lands in the Mexicali Valley in Baja California, under the provisions of the Water Treaty on the Colorado River entered into by the United States and Mexico in 1944. The main canal system in Baja California is operated by the Mexican subsidiary company of the District.

District Repays U.S. Government

The District has contracted to repay, and is repaying the United States over a period of 40 years, \$25,020,000, which is its share of the cost of the All-American Canal and appurtenant structures.

Present Irrigation and Drainage Facilities

In 1958, there were 497,000 acres under cultivation in the District. Due to the year-around growing season, many of these acres are double cropped. There are 240 miles of main canals and 1,534 miles of lateral canals which are used to deliver irrigation water to each 160-acre tract in Imperial Valley. All of the cities and towns in Imperial Valley are a part of the District and receive all of their water requirements from District canals.

Over the years, Imperial Irrigation District has constructed an extensive drainage system to provide a drainage outlet to each 160 acres of land. Imperial Valley was farmed from 1901 to 1922 without drainage. A 1922 bond issue provided \$2,500,000 for drainage, and a system of deep drains was started in 1923; by 1959 there had been completed 1,410 miles of open drains. Most of the drains discharge into the Alamo or New Rivers, which serve as natural outlet channels into Salton Sea.

The District's system in itself does not provide sufficient drainage for the land as there is very little lateral movement of ground water to the District drains. The drains provide only an arterial system into which the individual landowner can dispose of his drainage water. As a rule, this is accomplished by installation of an underground system of tile drain lines. This program started in 1929. It was initiated and carried on by the District until private contractors were organized and equipped to take over. By the end of 1959, there had been installed about 7,400 miles of farm tile lines serving about 252,000 acres.

Power Facilities

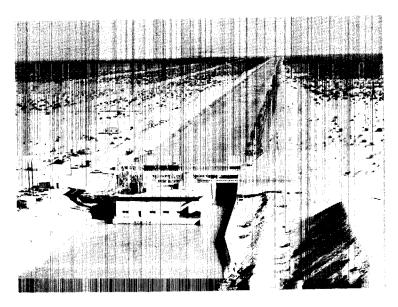
Imperial Irrigation District entered the power generation and distribution business with a three-unit diesel plant in Brawley in 1936. In 1937, the first full year of operation, the District had a generating capacity of 2,250 kilowatts and sold 5,400,000 kilowatt-hours to 1,432 customers.

In 1959, the District had generating capacity of 174,650 kw and sold 624,000,000 kwh to 32,040 customers.

Not only are there more people, but people use more electrical energy. In 1937, the average use was 2,000 kwh per domestic customer; in 1959 it was 6,700. The national average for 1959 was 3,550.

The service area comprises 6,600 square miles and includes Imperial County and most of Coachella Valley. The District owns and operates four hydro plants on the All-American Canal, the diesel plant in Brawley, the steam plant in El Centro, and has a contract for 30,000 kw from the Parker-Davis system of the U. S. Bureau of Reclamation, as well as the right to 10,000 kw of power from the Axis steam plant of California Electric Power Company. Bonded indebtedness for the power system was \$30,093,000 as of December 31, 1959. Electric rates have not been raised since operations commenced in 1936. Construction, operation and maintenance of power facilities in 1959 required approximately 420 employees and an expenditure of \$8,033,348.

Water in the Desert



An aerial view of the All-American Canal and Drop 2 hydroelectric plant of the Imperial Irrigation District. Located about 25 miles East of Holtville, the Drop 2 plant has a rated capacity of 10.000 kilowatts and uses a 25 foot head of water. In the distance are the Sand Dunes.

The Salton Sea

Based on an Address by M. J. Dowd

The Colorado Desert, also known as Salton Basin, extends from San Gorgonio Pass, where the adjoining mountains reach elevations in excess of 10,000 feet, southeasterly some 200 miles through Coachella Valley, Imperial Valley, and the Mexicali Valley of Baja California, Mexico, to the dividing ridge of the Colorado River Delta in Baja California. This broad, flat ridge or saddle has an elevation, at its lowest point, of about 47 feet above sea level and divides the delta into two parts. To the east of the ridge, the drainage of the delta is southerly into the Gulf of California; to the west, the delta drains to the north through Imperial Valley to Salton Sea.

A large part of Coachella and Imperial Valleys is below sea level. Palm Springs is 500 feet above sea level, but Indio is a few feet below, and Calexico, on the boundary between California and Baja California, is approximately at sea level. In between, all is below sea level, the lowest point being located near the northerly end of Salton Sea, where the elevation is 273.5 feet below sea level—approximately the same elevation as the lowest point in Death Valley.

The drainage area of this large enclosed basin—the Colorado Desert—comprises some 7,500 square miles, of which about 1,000 square miles is in Baja California, Mexico. It is an area of intense summer heat—for more than 110 days out of the year, the maximum temperature is in excess of 100 degrees. It is also one of the most arid sections of our country, with an average rainfall of only three inches—some years it is less than one-half inch.

Few regions of our nation have had as interesting a history as has this area; the history of its geologic past, as well as the history of the struggle between man and nature in which man fought to control an unruly river and use its waters to convert a barren desert into one of the great agricultural producers of the western hemisphere.

Geologic History

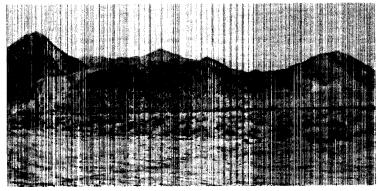
Going back into the geologic past several million years, we find an inland sea which included the present Gulf of California and extended through Imperial and Coachella Valleys and on far to the north through San Joaquin and

Sacramento Valleys and beyond. There followed a tremendous upthrust, which was the birth of the mountain ranges we now see around us, and the entire area came up out of the sea. As evidence of this upthrust, very large oyster beds are now found near the mountains on the west side of Imperial Valley not far from the Mexican boundary and marine fossils and shells are found in the San Felipe Valley, many hundreds of feet above sea level.

Following this upthrust, there was a gradual settling or down folding of the central portion of the area now occupied by Imperial and Coachella Valleys; and as this went on, the Colorado River began disgorging its silt into the area, as the river meandered back and forth across its delta, depositing the vast quantities of silt eroded from the 240,000 square miles of its drainage area and its thousands of miles of deep canyons. One has but to stand on the brink of the Grand Canyon of the Colorado in Arizona and look at that great chasm to get some appreciation of the tremendous quantity of material that has been eroded during past ages by the river and spread over its delta.

Gradually the delta extended itself for hundreds of miles southerly into the Gulf of California, and westerly and northerly through the Mexicali Valley and into Imperial Valley. While we are not certain how deep the river silt is in Imperial Valley, we know that in places it has a depth of as much as 2,000 feet.

Lake Cahuilla



The old Lake Cahuilla shore line shows clearly on the mountains to the northwest of the Salton Sea. The shore line has an elevation of over 30 feet above sea level. This photo is taken about two miles south of the Imperial-Riverside County line near U.S. Highway 99.

There must have been periods of many years when the entire flow of the river was into Imperial Valley. This is evidenced by the vast lake which was formed, the shoreline of which can still be seen at many places around Imperial and Coachella Valleys, particularly along the mountains to the west of the northerly end of Salton Sea. Those who have not made the trip to Salton Sea should do so; it is well worthwhile. It will be noted that the old shoreline shows very distinctly, particularly in the vicinity of Travertine Point. This shoreline has an elevation of something over 30 feet above sea level—which is the height at which the lake would overflow back into the Gulf of California. That the water stood at this elevation for many years at a time is evidenced by the thickness of the travertine deposit on the rocks below the water line. The lake which has been given the name Lake Cahuilla, was some 150 miles in length, with an average width of about 30 miles and a maximum depth of over 300 feet.

However, it would appear that for at least 500 years before development of Imperial Valley was attempted by man, there had been no major diversion of the river into the Valley for any extended period, and the area had lain as a naked, burning desert, with only an occasional clump of greasewood and here and there a few willows along one or two of the shallow water courses, which now and then received some overflow during spring floods of the river. Records indicate that there was some water in Salton Sea in the 1850's and early eighties, and in 1891 the overflow of the river was sufficient to cover about 100,000 acres; but when development commenced in 1900, Salton Sea was dry and a salt works was in operation near what is now the northerly end of the sea.

Early Crossings of Imperial Valley

It was across this desolate, waterless waste from Yuma to the Coast Mountains that De Anza made his way in 1774, searching for a land route from northern Mexico to Monterey in California. On this and his several later trips, he and his party suffered tremendous hardships in traversing the one hundred or more miles from the Colorado River across the Imperial Valley to the mountains on the west.

The same hardships were experienced by General Kearney and his army in 1847—some seventy years after De Anza's first trip—in his march through this region to San

Stagecoach Station



The old adobe Araz stage depot, built in 1856, is located five miles west of Yuma, Arizona, on U.S. Highway 80. This station was a regular stop for the Butterfield stages en route from St. Louis to San Francisco.

Diego, and in the following year by the Mormon Battalion. During the gold rush of '49 and '50, thousands passed through Imperial Valley, and many lives were lost on this treacherous desert; about a decade later, the same route was travelled for several years by the Butterfield Stages en route from St. Louis to San Francisco. For all of these, the trip from Yuma across Imperial Valley to the mountains was the most feared and considered to be the most hazardous part of the transcontinental journey. This is the area man sought to subdue and develop at the turn of the century.

Development of Imperial Valley

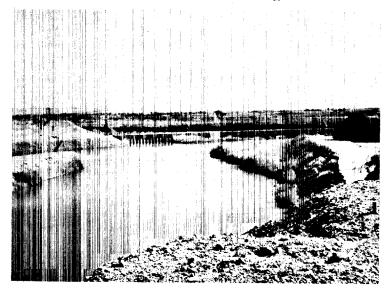
The possibility of bringing Colorado River water to reclaim the million acres of desert land in Imperial Valley was realized as early as 1850, but it was not until 1900 that private financing was secured and canal construction started. The first water from the river, sixty miles away, reached Imperial Valley in June 1901, and there followed one of the

most rapid irrigation developments, on a large scale, ever witnessed in our nation.

However, all was nearly lost in 1905, when control of the river diversion was lost. There resulted the much publicized break, and for nearly two years the entire flow of the river passed uncontrolled through Imperial Valley to Salton Sea.

In addition to the disastrous effects which the break had on the early development, the people had many other difficulties to overcome. Among these was the fact that Imperial Valley was isolated from centers of population by wide deserts and high mountain ranges, making transportation a serious problem. There were also annual floods of the Colorado River, followed by a low-flow period each year when diversion problems became serious. The flood menace required large expenditures by the people of the Valley in

Rockwood Heading



In 1918 Imperial Irrigation District built the Rockwood Heading on the Colorado River in order to improve diversions. This structure is about one mile north of the international boundary and one-half mile north of the Hanlon Heading, the original intake structure. The Rockwood Heading was named for Charles R. Rockwood, chief engineer of the California Development Company.

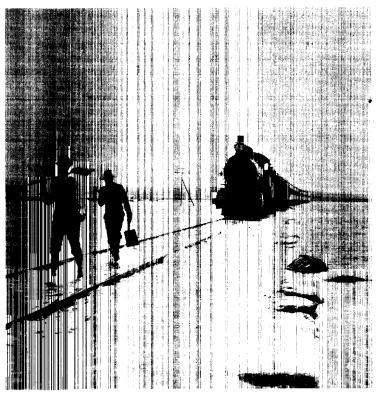
the construction and maintenance of an extensive protective levee system in Mexico; another break, such as the one in 1905-07, might have engulfed the entire Valley. They had to contend with the heat and dust of the long summer period and with a water supply heavily laden with silt. The silt choked their canals, piled up on their lands, and required costly treatment of the canal water to make it suitable for domestic use—no potable local water supply was or is available in the Valley. The planting, growing, and harvesting of nearly every crop had to be adjusted to the new and different conditions not experienced elsewhere. The people also had to cope with international complications which resulted from the fact that their main canal system had to be brought to the Valley through Baja California, Mexico. These were but a few of the major difficulties.

Another dramatic chapter in the history of Imperial Valley covers the many years of struggle by the people of that Valley, later joined in by all sections of Southern California, to secure passage by the Congress of the Boulder Canyon Project Act authorizing the construction of Hoover Dam and the All-American Canal, and also making possible the Colorado River aqueduct to Southern California. All of these great works are now realities, but this chapter need not be detailed here as it is so well known throughout the country.

It was by the will and determination of the people to overcome all obstacles and to fight through to success, that water was brought to the land, one by one the problems were met, and the great transformation which we see today was accomplished. Although the area is favored by a year-round growing season and good soil, it took a lot of "blood, sweat, and tears" to convert, within this short period of fifty years, a half million acres of barren desert into an agricultural empire now producing crops with an annual value approaching \$150,000,000.

When one now sees the hundreds of thousands of acres of farms in Imperial Valley producing bountiful crops of every type the year around and the homes with all the modern conveniences; the prosperous and modern cities and towns which dot the area, with most of the stores and buildings and many of the homes—both urban and rural—air conditioned; and the hundreds of miles of paved highways and roads, it is difficult for one to visualize or appreciate what these people had to endure and overcome in conquering the desert. In my opinion, there is no finer example of what has made America great than that which is found in the history of the development of Imperial Valley.

Salton Sea 1906



The above graphic picture taken in 1906 shows the Southern Pacific tracks along the Salton Sea inundated by the flood waters. The tracks had to be moved to higher ground several times as the Sea rose.

Nationwide Interest in Imperial Valley

With such an interesting geologic background and eventful and colorful period of development as Imperial Valley has had, it is no wonder that it has attracted the interest of the whole nation and has offered such a fertile field for writers of all types, both literary and scientific. Perhaps the best known novel about Imperial Valley is "The Winning of Barbara Worth"—a best-seller in its day—written in 1910 by Harold Bell Wright. The story is built around the river break of 1905-07 and the heroic and costly efforts to close the break and return the river to its channel to the

Gulf of California. Since then, many hundreds of books, magazine articles, scientific papers, and newspaper stories about the Valley, or some of the major events in its history, have been published.

Throughout the many years that the river legislation was before the Congress, the flood menace to Imperial Valley from the Colorado River was publicized all over the nation. The possibility of inundation of half a million acres of farms and a number of cities lying below sea level, from which the water could be removed only by natural evaporation, made a very dramatic story. However, this publicity was based on actual fact and was to be expected, and it did, at the time, severely damage the financial credit of the Valley.

During the same period, another type of story was circulated to the effect that the continued deposit of the large volume of Colorado River silt on its delta was so increasing the weight on that segment of the earth's crust that it would sink and permit the waters of the Gulf to rush in and submerge Imperial Valley. This type of sensational story, of which there have been a number similar in character, was not based on scientific facts or valid evidence but simply on someone's imagination or fancy, and is the kind that has been detrimental to Imperial Valley by creating unjustified doubts as to the permanency of its development.

New "Dangers" to Imperial Valley Concocted

With the completion of Hoover Dam and the All-American Canal, the last of the major problems which confronted Imperial Valley was eliminated; and it may now be said with confidence that no section of our nation is more assured of a permanent and prosperous future than is this Valley.

But a certain class of writers was not to be discouraged by this changed situation. Of recent years, they have discovered new "dangers" to use as a basis for their books and articles predicting the doom of Imperial Valley. Of course, Coachella Valley would have to share the same fate as Imperial Valley, should these imagined "dangers" prove to be real, but as a rule this is overlooked and most of such stories deal mainly with the terrible fate awaiting Imperial Valley.

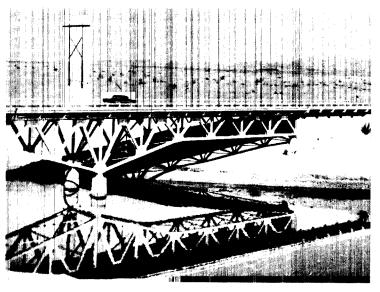
As examples of such stories, there may be mentioned (1) the book written by a New York yachtsman, Randolph Leigh, called "Forgotten Waters," which was published in 1941; (2) an article appearing in the April 1950 issue of

Harper's Magazine under the title "A Cataclysm Threatens California," by Alfred M. Cooper; and (3) an article entitled "California's Weird Overflowing Sea," by Keith Monroe, which appeared in The Saturday Evening Post of August 30, 1952.

These stories are based on one or more of the following erroneous theories:

- l. That Hoover Dam has cut off the tremendous volume of silt in the river which formerly reached the Gulf of California, with the consequence that the high tides of the Gulf—the second highest in the world—no longer have this silt to feed on and are now eroding and washing away the delta and will soon eat through the comparatively low barrier in the delta between the Gulf and Imperial Valley, which will permit the waters of the Gulf to rush into the Valley and it will then be covered by an inland sea, as it was ages ago.
- 2. That over the past, earthquakes have opened up deep underground cracks in the delta, through which water from the Gulf is seeping into Salton Sea, which, it is claimed,

Bridge Over the All-American Canal



One of the three bridges carrying U.S. Highway 80 over the All-American Canal. At this point Highway 80 parallels the canal through the sand dunes.

is evidenced by the rise in that sea; and that these cracks will enlarge until the overlying area of the delta collapses, permitting the Gulf to reclaim its own.

3. That Salton Sea is a mysterious and weird body of water, about which little is known; that it has been rising rapidly of late and is now bursting its banks, with no way to stop it; and that it will continue to rise and gradually submerge a large part, if not all, of the farm lands, cities, and "villages" in the Imperial and Coachella Valleys.

These are intriguing possibilities, if they be true—which they are not—and it is easy to imagine how stories or articles predicting such a calamity would create so-called "reader interest" all over the country. But let me say at the start, that a categorical answer of "no" can be given to each and all of them. It is to be regretted that certain of the more responsible publishers of nationwide importance appear willing to accept and publish such stories, which can injure a section of our country, without first making certain that the authors are fully qualified and that all of the facts are correct.

Stories Based on Concocted "Dangers" Detrimental

In each of the three stories mentioned, their writers have taken a few actual facts, which they have colored and exaggerated to suit their purposes, and added speculative theories of their own, which cannot be supported by factual evidence. As a result, a reader not acquainted with the real facts gets the impression that the writer is an expert on the subject and that the destruction of Imperial Valley is really imminent.

To illustrate the effect of such stories, one of the weekly newspapers published on the Coast, commenting editorially on the Cooper article, advised the people of Imperial and Coachella Valleys to sell out while they could and buy Palm Springs property, as Palm Springs would soon have an ocean beach to add to its attractions. Also, there have been a number of Valley people who received telephone calls or letters from relatives in other parts of the country calling attention to one or more of these stories and expressing fear for their safety.

This is the humorous side of the picture, and to those who know what the real facts are, these stories would be laughable were it not for the serious side. Many people in various parts of the country have invested in real estate or loans on real estate in Imperial Valley, and others have

invested in securities issued by Imperial Irrigation District, Imperial County, and the cities and other public agencies in the Valley. When these investors read such stories, which appear to them to be factual, it raises doubts in their minds as to the safety of their investments. Such stories may also discourage others from making such investments. Of course, Imperial Irrigation District and other agencies do what they can to correct these erroneous stories, but it is a difficult matter for these local agencies to compete with a magazine of nationwide circulation. In any event, such stories are detrimental to the community affected and, in my opinion, damage the prestige of all publications.

Let us examine the cold facts as to whether the delta is being washed away from its top by erosion and from its bottom by seepage and leakage and whether Salton Sea is weird and mysterious and is now bursting its banks, uncontrolled.

Are the Gulf Tides Eroding the Delta?

How do we know the waters of the Gulf are not eroding or eating away the delta?

First, something should be said about the delta itself. Due to the high silt content of the Colorado River in its natural state, its delta is as large as, if not larger than, that of any river in the world of comparable discharge. The delta covers several millions of acres and, as it was built up over past ages, it spread out to the west and north into Imperial Valley a distance of some 150 miles from the present location of the City of Yuma, and to the south to the Gulf of California and for as much as 100 miles into the Gulf. Considering the magnitude of the tides and tremendous volume of sea water they include, what we consider to be the large volume of Colorado River silt would be very small in comparison.

Consequently, even during periods in past centuries when the river may have been discharging its entire silt load into the Gulf, the dissipating and spreading of that silt by the waters of the Gulf was but a minor incident. In other words, the slope of the delta for as much as a hundred miles from the head of tide water out into and under the Gulf was established over the centuries by tidal action, and there is no evidence to indicate that this slope was in anywise affected by silt entering the Gulf.

But we know that for at least a hundred years before man under ook to control the river, a great percentage of its silt did not reach the Gulf, but was deposited over the broad areas of the delta above the effect of tide water by overflow of the banks of the river during much of each year. A survey of the river channel made in 1903 showed that the width near Yuma was about 800 feet, while downstream some 80 miles, which would mean near tide water, the channel was only half as wide; river bank overflow between the two points accounts for the decrease in size of the channel. Thus, if there had been a tendency for the tides to erode the delta because of the absence of Colorado River silt, such would have taken place during this period, but there is not the slightest evidence to indicate that it did.

Amount of Silt Reaching Gulf

We also know that the amount of silt reaching the Gulf was changed very little by the construction of Hoover Dam. From 1905 to 1907, during the break of the river into Imperial Valley, all of the water, and, of course, all of the silt, came into this area; none reached the Gulf. In 1908-09, natural conditions in the delta, which had been developing for several hundreds of years, caused a major change in the river's course some 20 miles below the California-Mexico boundary by which the river diverted itself entirely away from the old channel below that point and followed a course westerly into the Volcano Lake area, which is located on the dividing ridge or saddle of the delta heretofore referred to. Had man not prevented the river from continuing westerly, there is no question but that its course would have continued into and through Imperial Valley, as it had done many times over ages in the past; and Lake Cahuilla would have been recreated.

Thus it was that the river deposited practically all of its silt in the extensive Volcano Lake area from 1909 until 1922, and records indicate a silting in of the area at a rate of about one foot per year.

Due to the dangerous situation which this rapid silting in of the Volcano Lake area created to the lands in the Mexicali and Imperial Valleys, Imperial Irrigation District in 1922, was forced to divert artificially the entire river out of the Volcano Lake area and into what was called the Pescadero Basin—a low-lying area between the Volcano Lake area and the river's old course along the Sonora Mesa. The Pescadero Basin absorbed practically all of the silt until the river was controlled by Hoover Dam.

So, for at least 30 years prior to the completion of Hoover Dam, very little of the river's silt had been reaching the Gulf, and the dam did not change this situation, as contended by some of the so-called "experts" in their stories.

As further evidence that the delta is not being eroded,

we have the report of the American Section of the International Boundary and Water Commission, United States and Mexico, that aerial photographs taken in 1942 and 1949 of the upper portion of the Gulf of California, compared with maps made by the United States Navy of the same area in 1873-75, show no discernible change in the past 75 years in the position of the mouth of the river, the head of the Gulf, or the deltaic Montague Island, which is located in the Gulf 1.6 miles off the mouth of the river. If the tides were washing away the delta, such would first be reflected in conditions in and around the mouth of the river.

The American Section of the Commission also reports that the extreme high tides of the past have now decreased somewhat, due to the fact that Hoover Dam has controlled the floods of the Colorado River. It was this large volume of flood water, in the past, meeting the Gulf tides that caused their extreme height. The effect of the lower tides would be to decrease the tendency, if any, of the tides to erode the delta.

Lastly, the delta is still growing. While Hoover, Davis, and Parker Dams have cut off 95 per cent or more of the river's silt, there is still some reaching the delta by erosion of the coarse silt and sand from the bed of the river below Parker Dam (the lowest of the three dams). This silt deposited on the delta, while not large in amount, is nevertheless increasing the thickness of the barrier between the Gulf and Imperial Valley.

Other evidence could be given, but it would seem that the foregoing should be sufficient to prove beyond question that the delta is not being eroded or washed away by the Gulf's tides. Finally, even if it were being so eroded, it would be a comparatively small task to protect the small section of the delta where there would be any danger whatever from a breaching of the barrier between the Gulf and Imperial Valley.

Fallacy of Seepage Theory

What about the possibility of cracks in the delta through which water may be seeping into Salton Sea?

This possibility was first rumored following the San Francisco earthquake in 1906, at the time of the break of the Colorado River into Imperial Valley which was causing Salton Sea to rise rapidly. Someone had the idea that that earthquake, and possibly others, had opened up cracks in the delta through which there was seepage from the Gulf and claimed that such was the cause of the rapid rise

in Salton Sea. Very careful investigation at that time showed no justification for such a contention. This theory has recently been revived by certain writers, but no actual proof or valid evidence is offered to support it—and none can be.

The delta of the Colorado River may be likened to α dam between the Salton Sea and the Gulf of California. It is a dam constructed over countless ages by nature with silt from that river deposited under water as the river mean-dered back and forth across its delta.

This dam has a height of about 300 feet. Let us compare it with a dam of similar height, if built by man. The top width of the man-made dam would be, perhaps, 100 feet—the top of nature's dam has a width of from 8 to 10 miles. The man-made dam would have a freeboard of, maybe, 5 or 10 feet—nature's dam has a freeboard of 35 feet above maximum tide of the Gulf. The thickness through the base of the man-made dam would be something like 2,000 feet—the comparative thickness through nature's dam is 140 miles. And at the normal height of the water above nature's dam—sea level—the thickness of that dam is 60 miles.

Taking these factors into account, plus the additional facts that nature's dam has remained intact for countless centuries and there isn't the slightest evidence of seepage from the Gulf, it would seem that the people of Imperial Valley have little to fear from the possibility of nature's dam failing.

Salton Sea

Is Salton Sea weird and mysterious and will it, in the future, submerge a large part of Imperial and Coachella Valleys?

Salton Sea is located in the northern part of Imperial County and the southern part of Riverside County, California. It must receive not only the runoff from storms over the 7,500 square miles of the enclosed basin it drains, but also the return flow from some 700,000 acres of presently irrigated land, including 550,000 acres in Imperial and Coachella Valleys, California, and 150,000 acres in the Mexicali Valley of Baja California, Mexico.

Reference has already been made to old Lake Cahuilla, the shoreline of which can be seen in various parts of the Imperial and Coachella Valleys, representing long periods of Colorado River inflow. Other shorelines exist at lower elevations, indicating that in past centuries there were shorter periods of overflow of the river into the basin before a change

in conditions in the delta would force the river to discharge back into the Gulf again.

In 1907, at the time of the closure of the break of the river into Imperial Valley, the sea covered about 350,000 acres and had reached a maximum elevation of 195 feet below sea level. For the next 12 or 13 years, an excess of evaporation over inflow caused the elevation of the sea to drop rapidly. However, by 1920, irrigation development in the Imperial and Mexicali Valleys had reached a point where return flow to the sea had caught up with evaporation. For the next few years, the rate of lowering slowed down, with elevations levelling off until in 1925, when a low point of about 250 feet below sea level was reached. From then until 1931, there was a rise in the sea of about 7 feet, due in part to a plentiful water supply for irrigation and in part to several severe local winter storms. However, water shortages, particularly in 1931 and 1934, which caused large crop losses in Imperial Valley, resulted in a drop of several feet in the sea to another minimum elevation of -248 feet in 1935.

Elevation Now 234 Feet Below Sea Level

Since the commencement of storage behind Hoover Dam in February 1935, there has been an ample water supply available to the lower river, and the sea has been rising at varying rates. The elevation is now approximately 234 feet below sea level.

There was a gradual rise in the surface elevation of the Salton Sea from 1935 until 1950. During the period from 1950 to 1955 the sea rose more rapidly—at an average rate of about 1 foot per year. However, since 1955, except for seasonal fluctuations, the level has remained near the 234 feet below sea level mark*. The rise in the Sea between 1935 and 1955 apparently attracted the attention of several writers who have attempted to capitalize on it and make it appear that the rise is unaccountable; that no one knows why it is occurring—unless it be due in large part to seepage from the Gulf; and that the rising sea threatens the existence of Imperial and Coachella Valleys.

*Salton	Sea	Elevations	since	1955	as	of	December	31	of	each	year
are	as fo	ollows:									

1955	234.35
1956	234.50
1957	234.45
1958	234.60
1959	

Hoover Dam



Hoover Dam, authorized by Congress in December 1928. The storage of water commenced in 1935. The dam guarantees Imperial Valley against floods, silt, and drought.

One writer refers to the sea as being "weird" and "mysterious" and says that it is "bursting its banks," uncontrolled. Another claims Salton Sea was created by seepage through cracks opened up by "a minor quake" in 1904 and that this, together with subsequent events, "has set the stage for the inundation of three million acres of Southern California's best farm land and the destruction of twenty-five towns and villages in Imperial and Coachella Valleys." He says further that "West Coast scientists do not question the likelihood of this impending cataclysm they differ chiefly in their estimates as to when the event will occur." These are but samples of the nonsense contained in these stories.

Rise in Salton Sea and Factors Involved

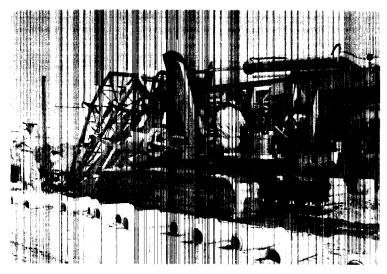
No, there is nothing weird or mysterious about the Salton Sea, or about its rapid rise between 1950 and 1955. Neither is the rise of 1.5 feet in 1951 and again in 1952 unprecedented nor is it unaccountable. Whenever, during a year, the inflow to Salton Sea, from local storms and return flow from the irrigated lands, exceeds the amount removed from the sea by evaporation, the level of the sea rises.

In the last 50 years, there have been a number of times when the level of the sea has come up as much as 1.5 feet in a year. As a matter of fact, although major storms in the drainage area are infrequent, there have been a number of instances when the runoff from a single storm has raised the elevation of the sea from 0.75 of a foot to 1.5 feet.

Another factor has been the increase in acreage irrigated, amounting to some 100,000 acres, with a consequent increase in the requirements for Colorado River water, a part of which showed up as return flow to Salton Sea. Also, there has been a change in the crops grown. The year 1951 saw cotton planted in Imperial Valley for the first time in over 20 years. About 28,000 acres were planted in that year, 88,000 acres in 1952, and 108,000 acres in 1953 (for the past several years it has been cut back to between 40,000 and 45,000 acres). Cotton requires a very heavy usage of water during the summer, resulting in a greater return flow than for many other crops. In 1948, diversions from the Colorado River to Imperial and Coachella Valleys through the All-American Canal totalled approximately 2,900,000 acre-feet, while for the year 1953 this total was over 3,900,000 acre-feet—an increase of some 1,000,000 acre-feet.

A further factor is the increase in the mileage and efficiency of the drainage system in Imperial Valley, which has increased the inflow to Salton Sea. Imperial Irrigation District

Field Drainage Tile Installation



Almost 7,400 miles of drain tile have been installed under individual Imperial Valley farms. At the present time about half of the irrigated acreage in the area is served by underground drainage in the fields. Tile is installed at a depth of from four to ten feet with varying distances between the lines, depending on the type of soil. Machines such as the one pictured above install tile at between 200 and 400 feet per hour.

operates and maintains some 1,400 miles of drainage canals—not including 128 miles of the Alamo River and New River channels, which serve as main outlets to Salton Sea. In addition land owners have installed almost 7,400 miles of farm tile drains as of December 31, 1959, draining over 252,000 acres of land. New farm tile drains are being installed at the rate of about 500 miles a year. In 1948 records show about 1,500 miles of these tile drains served slightly less than 71,000 acres.

All of these factors combined explain the rise of Salton Sea. An examination of the record of monthly elevations shows that during the summer of 1951, instead of the sea's dropping a foot to a foot and a half, as it usually does, the elevation remained practically constant until the fall months, when it began its usual winter climb. During the summer of 1952, the level of the sea dropped about half a foot before the start of its winter rise. The present elevation of 234.30 feet below sea level (Dec. 31, 1959) is only about .30 feet

higher than it was a year ago (and about the same elevation as it was on December 31, 1955). As development of the area increases, the factors mentioned will no doubt result in some further increase in the height of the sea—but there is nothing weird or mysterious about it, and it can be fully accounted for.

Future Elevation of Salton Sea

Many have asked the question "At what elevation is it anticipated that the level of Salton Sea will be stabilized?" There are a number of unknown factors which make a definite answer difficult at this time. For instance, the 150,000 acres in Baja California, which is part of the drainage area of Salton Sea, has only a partial drainage system. An extensive system of drains must be constructed to permit continued farming of this area. What will these drains contribute to Salton Sea? Furthermore, the 1944 water treaty between the United States and Mexico is silent as to the question of the wasting of water from Mexican canals and farms to Salton Sea. What may this waste amount to in the future?

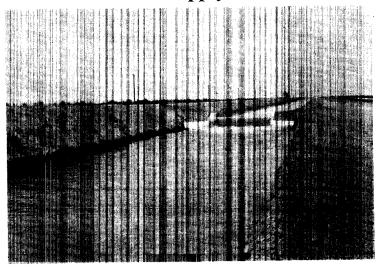
It is known that as upstream development on the Colorado River occurs, there will result some increase in the salinity of the water in the lower river above its present average of about one ton of salt per acre-foot. Just what this increase will amount to has not yet been determined, but it can mean that the area tributary to Salton Sea and irrigated with Colorado River water, will receive as much as five million or six million tons of salt per year. This tonnage will have to be removed by drainage systems and passed on to Salton Sea each year, in order to maintain a salt balance in the area. How much water will it take to do this?

The importance of Salton Sea as a drainage basin has been realized for a great many years, and studies have been made, from time to time, as to its behaviour and what might be expected in the future. In the year 1924, the Federal Government, by Executive Order, withdrew from all forms of entry all public lands of the United States in the Salton Sea area lying below an elevation of 244 feet below sea level, and created a Public Water Reserve. At that time, the elevation of the sea was approaching 250 feet below sea level, and the freeboard of 6 feet was thought to be sufficient. But this was without a proper consideration of future conditions.

In the middle 20's, the United States Geological Survey undertook an investigation of the probable future stages of Salton Sea and, in a report issued in 1927, reached the conclusion that the future stabilized elevation of the sea, when the tributary area was fully developed, might be between elevations 223 feet and 226 feet below sea level, but that for safety the maximum elevation should be considered as 220 feet below sea level. This is about 14 feet higher than the present elevation. Based on these conclusions, in 1928 the Federal Government, by another Executive Order, withdrew from all forms of entry all public lands of the United States in the Salton Sea area lying below this elevation of 220 feet below sea level, adding the withdrawn area to the Public Water Reserve created in 1924.

In view of all of these facts, it may be anticipated that Salton Sea will have a tendency to rise for a number of years, the rate depending upon various factors, including weather conditions over its drainage basin. It remains for the future to show whether the elevation of -220 feet set by the U.S.G.S. may or may not be too conservative. But it can be stated with assurance that there is no danger of the inundation by the sea at any time of any appreciable amount of good farm land nor is there any such danger to any of the cities or towns in either Imperial or Coachella Valleys.

District Supply Canal



The new Vail supply canal in the northern section of Imperial Valley. This canal is a part of over 1.700 miles of canals operated and maintained by the District for its users.

Acquisition of Private Lands by District

As a result of the investigation of the United States Geological Survey, and also based on its own studies in the late 20's, Imperial Irrigation District undertook to acquire the private lands under and around Salton Sea lying below an elevation of 230 feet below sea level. This did not mean that the District did not realize the possibility of the sea's reaching a higher elevation in the future, when development of the entire area tributary to the sea has been completed, but it was felt at the time that such acquisition was as much as the District could then undertake.

As a result, the District has acquired fee title to, or flooding rights on, practically all of the private lands lying below the -230 foot elevation. In connection with its work of establishing this drainage reserve, the District has expended nearly \$350,000 to date.

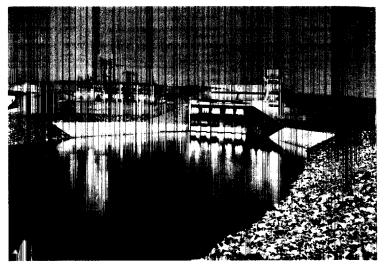
District Does Not "Waste" Water

From time to time, one hears it said that Imperial Irrigation District diverts an excessive amount of water from the Colorado River and wastes it to Salton Sea in order to build up its water rights; also that the District wastes water to Salton Sea for power purposes. Neither of these accusations is true.

The irrigation canal system operated by Imperial Irrigation District totals some 1,800 miles in length. In order to give service through this system to its thousands of water users, there must be some water used for regulatory purposes, as will be recognized by anyone familiar with irrigation operations. But the amount used for regulation is held to a minimum and now is considerably less than was required before the construction of Hoover Dam and the All-American Canal, when the high silt content of Colorado River water resulted in the silting of the canal system and made necessary the use of a large amount of water for sluicing.

There would be no object in the District's diverting more than its actual requirements in an attempt to build up its water rights. The District's rights are based upon appropriations made in the 1890's. Under California water law, so long as the District uses due diligence—and there has never been any question but that it has—in putting to use the water so appropriated, its rights relate back to and are measured by the amount of such appropriations and not by the amount

Pilot Knob Hydroelectric Plant



View of Pilot Knob plant. One of the four hydroelectric installations built on the All-American Canal by Imperial Irrigation

it may be using this year or may have used last year or five years ago.

Neither has the District in the past diverted, nor does it intend in the future to divert, water from the Colorado River through the All-American Canal solely for the purpose of developing power at the hydroelectric plants in Imperial Valley. It can be stated definitely that the only water which goes through these power plants is that required to meet irrigation and domestic demands within the District.

Discharge from the Pilot Knob plant, on the All-American Canal, is directed back into the Colorado River and is therefore in a different category from other plants on the Canal, which are in Imperial Valley proper and within the drainage area of Salton Sea.

Salt Balance

Mention has been made of the use of Salton Sea—and it is a very important use—to maintain a "salt balance" in the irrigated areas tributary to the sea. The necessity of maintaining a salt balance has become a well established

principle throughout the Southwest. It means that, in order to assure continued production of an irrigation project, it is necessary to remove from the project each year, on the average, at least as much salt as is brought into it yearly with the irrigation water.

For a number of years, the District has maintained records of the tonnage of salt coming into Imperial Valley through the All-American Canal water supply and from Mexico through the Alamo and New Rivers, and the amount of salt being removed from the Valley to Salton Sea. Until 1949, the amount of salt being removed each year was less than that being brought in. For the year 1948, as an example, approximately 2,758,000 tons of salt was brought into Imperial Valley and only about 2,645,000 tons removed. However, commencing in 1949, there has been a favorable salt balance, as shown by the following figures:

IMPERIAL IRRIGATION DISTRICT SALT BALANCE

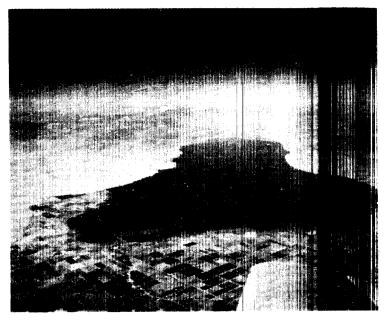
Yearly Summary 1949-1958

Year	Tons of Salt Into Imperial Valley	Tons of Salt Removed	Per Cent Loss or Gain
1943**	2,157,579	1,999,269	7.34% loss
1944	2,412,697	2,17 3, 215	9.93% loss
1945	2,622,624	2,410,519	8.09% loss
1946	2,793,127	2,380,269	14.78% loss
1947	2,794,702	2,431,150	13.01% loss
1948	2,758,131	2,645,241	4.09% loss
1949	2,652,461	2,797,678	5.47% gain
1950	2,833,931	2,940,201	3.75% gain
1951	3,149,137	3,232,542	2.65% gain
1952	3,119,259	3,440,177	10.29% gain
1953	3,347,643	3,758,443	12.27% gain
1954	3,216,353	3,732,950	16.06% gain
1955	3,664,023	3,822,347	4.32% gain
1956	4,119,389	4,150,049	0.74% gain
1957	3,788,958	3,993,008	5.39% gain
1958	3,257,361	3,896,120	19.61% gain
(1943-1958)	48,687,375	49,803,178	2.29% gain

^{**}From February 1

It is expected that in the years to come, as the drainage system is further extended and its effectiveness increases, the results will show an even more favorable increase in the percentage of gain of the salt removed from the Valley. The question remains, as previously stated, as to how much inflow to Salton Sea in the future will result from the main-

Salton Sea from 30,000 Feet



-(Official U.S. Navy Photo)

The above photo is one of the few showing the entire Salton Sea. This body of water is approximately 34 miles long and varies from 9 to 15 miles wide. The Imperial Valley is in the foreground and Coachella Valley can be seen at the far end of the Sea. The Alamo and New Rivers, which serve as main outlets for drainage and empty into the Salton Sea, are visible.

tenance of a salt balance in the irrigated areas of Coachella, Imperial, and Mexicali Valleys and the answer will be a factor in the future stabilized elevation of the sea. But to repeat, Salton Sea does not now, nor will it in the future, constitute a "threat" to either Imperial Valley or Coachella Valley.

Salton Sea Development

Boat owners, fishermen and water sports enthusiasts from Southern California have been attracted to Salton Sea in increasing numbers. Developers have spent large sums of money building marinas, boat launching facilities and yacht clubs on the northern shores of the Sea.

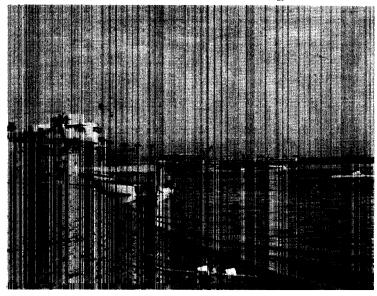
Within the past two years a planned community has been developed envisioning in excess of 30,000 homesites. To date a subdivision of approximately 15,000 residential, multiple family, and commercial lots has been recorded with Imperial County.

The development on the western side of the Salton Sea includes: hundreds of miles of paved roads, a modern 60-unit motel, an 18-hole golf course, commercial buildings, restauants. To date over 200 homes have been built.

An airport with a 3,500-foot landing strip has been operating for some time, and an additional 4,500-foot strip was recently completed. Work is progressing toward construction of full airport facilities including a control tower, hangars, restaurant and a home development with backyard facilities for parking private planes.

A modern private yacht club was recently opened on

Recreational Facilities Expanded



Typical of the increasing recreational facilities around the Salton Sea is a marina and beach at the North Shore Beach and Yacht Club a few miles north of the Imperial County line on State Highway 111. A new motel has recently been completed across the street. Many miles of paved streets and access roads have been built, and ample room for parking has been provided in the general area.

the North Shore which includes a restaurant, cocktail lounge, and locker rooms. The marina shoreline has boat launching facilities, cabanas, a swimming pool, and tennis courts.

Salton Sea State Park includes about 20 miles of shoreline, with some facilities for parking trailers and launching boats.

During World War II the navy operated a small Sea Plane Base at the southern end of the Sea. This base was later taken over by the Sandia Corporation, a subsidiary of Western Electric Company, to carry on tests for the Atomic Energy Commission. A target located in a restricted area about 8,000 feet off shore is used by the Strategic Air Command as a part of the tests.

Natural resources around the Sea include a hot mineral springs near the southeastern corner and a steam well south of the southern shores. Geothermal steam electric generation is being explored using the underground steam. "Rockhounds" have found deposits of black obsidian and other semi-precious gems in the area surrounding the Sea.

For many years "mud pots" at the southern end of the Sea emitted pure carbon dioxide. The rise of the sea within the past few years has covered the mud pots and they are no longer visible.

Conclusion

This brief outline of the geologic past of the Colorado Desert and of the great accomplishments involved in the development of Imperial Valley, together with the presentation of the real facts and supporting evidence relative to Salton Sea and the delta of the Colorado River, has been given with several purposes in mind.

First, to answer fully the major fallacies and some of the more important misstatements which have appeared in topical books and articles during recent years, and thereby prove that the purported dangers to the permanency of Imperial Valley are not real and do not exist. It was not felt necessary to answer all of the incorrect or exaggerated facts, or erroneous implications, which these stories have contained —and there are a great many more of them.

Second, to point out some of the many dramatic events in the history of this area, in which both nature and man have participated, to show that there is ample material, having nationwide appeal available, for professional writers to draw upon. Therefore, there is no necessity for such writers to resort to incorrect facts, half truths, or fictitious

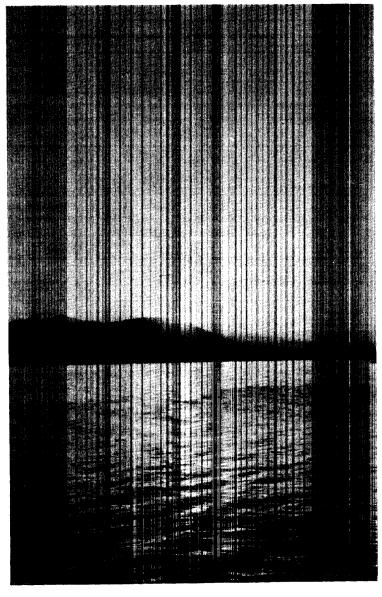
theories in order to create dangers threatening the life of Imperial Valley, presumably so that their stories may have sufficient reader interest.

Third, to caution the reader of topical books and articles, even though such articles appear in magazines of national circulation which are presumed to have a high rating for integrity, not to accept as the truth, all he reads. If of special interest to him, it will pay to investigate.

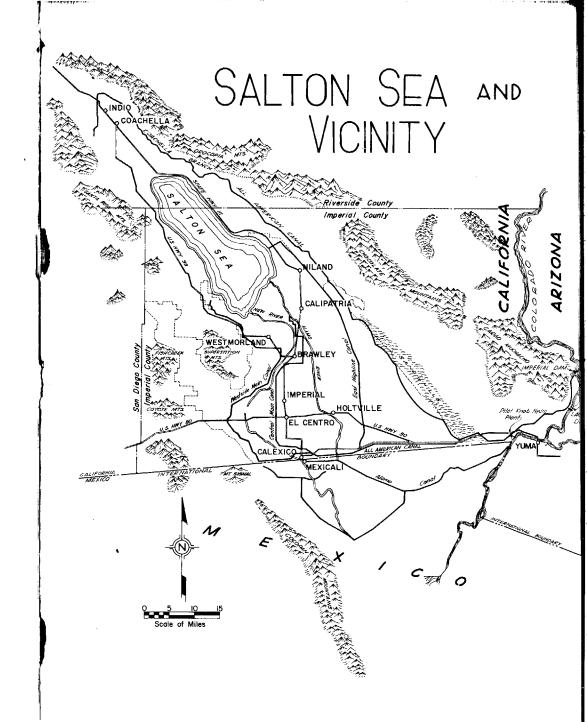
Fourth, to point out the great importance of Salton Sea, since it is the only outlet, and serves as the main collecting basin, for drainage water from about 150,000 acres of irrigated land in the Mexicali Valley, 500,000 acres of irrigated land in the Imperial Valley, and 50,000 acres of irrigated land in the Coachella Valleys.

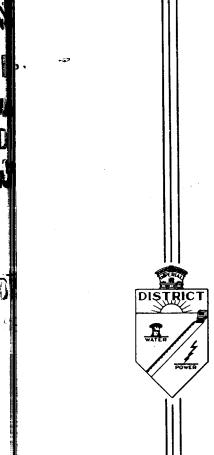
No, it will never be necessary for the people living in Imperial or Coachella Valleys to "sleep with their boots on" in fear of inundation by the waters of the river, the Gulf, or Salton Sea. Neither can any hope be held out to the real estate men of Palm Springs that they will be able to list an ocean beach among the attractions of their community.

Sea, Sunset, and Mountains



Looking west from the North Shore of the Salton Sea the setting sun presents an ever changing picture.





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